



Higher National Project-based Graded Unit Specification

General Information

This Graded unit has been validated as part of the HND Marine Engineering. Centres are required to develop a project-based assessment in accordance with this validated specification.

Graded Unit title: Marine Engineering: Graded Unit 2
(SCQF level 8)

Graded Unit code: HJ4L 35

Type of Project: Practical Assignment

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Graded unit purpose

This Graded unit is designed to provide evidence that the learner has achieved the following principal aims of the HND Marine Engineering:

- 1 Provide an award that on successful completion will allow learners to progress to a degree in engineering or a related subject discipline area.
- 2 Develop a range of communication, knowledge and skills relevant to the needs of marine engineers.
- 3 Develop knowledge and understanding of the external and internal factors that influence the performance of modern marine plant and vessels.
- 4 Develop a range of project management skills.
- 5 Develop the analysis and synthesis skills necessary to ensure the efficient operation of marine plant.

Credit points and level

2 Higher National Unit credits at SCQF level 8: (16 SCQF credit points at SCQF level 8)

Higher National Project-based Graded Unit Specification: General Information (cont)

Recommended entry to the Graded unit

It is recommended that the learner should have completed or be in the process of completing the following units relating to the above principal aims prior to undertaking this Graded unit:

- ◆ *Marine Engineering: Propulsion*
- ◆ *Marine Engineering: Auxiliary Systems*
- ◆ *Fundamentals of Control Systems*
- ◆ *Safety Engineering and the Environment*
- ◆ *Mathematics 2*
- ◆ *Marine Legislation and Leadership*
- ◆ *Marine Engineering: Management*
- ◆ *Marine Engineering: Strength of Materials*
- ◆ *Marine Engineering: Applied Mechanics*
- ◆ *Marine Engineering: Applied Thermodynamics*
- ◆ *Marine Engineering: Heat Engine Principles*
- ◆ *Marine Engineering: Naval Architecture*
- ◆ *Marine Engineering: Ship Construction and Survey*
- ◆ *Marine Engineering: Electrical Distribution Systems*
- ◆ *Marine Engineering: Electrical Power*
- ◆ *Marine Engineering: Process Control*
- ◆ *Marine Engineering: Pneumatics and Hydraulic Systems*

The nature of the project activity detailed in this specification is such that it is likely that centres wish their learners to embark on it from the start of the second year of the HND Marine Engineering programme. As it is anticipated that centres will deliver the HNC Marine Engineering as part of the first year of the HND, it is recommended that learners have completed all HNC Marine Engineering units before commencing this project. It is also recommended learners are given, a project brief and assigned a project after completion of third phase of HND Marine Engineering, ie before 2nd sea phase. A minimum three months of sea time/industrial experience/marine workshop/engine room simulator experience is recommended.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of this Graded unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Graded unit.

Equality and inclusion

This Graded unit has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on SQA's website:
www.sqa.org.uk/assessmentarrangements

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners

Graded Unit title: Marine Engineering: Graded Unit 2
(SCQF level 8)

Assessment

This Graded unit will be assessed by the use of a project-based *Practical Assignment* developed by centres. The project should provide the learner with the opportunity to produce evidence that demonstrates she/he has met the aims of this Graded unit.

The project undertaken by the learner must be a complex task which involves:

- ◆ variables which are complex
- ◆ relationships which need to be clarified
- ◆ a context which may be unfamiliar to the learner

The project must require the learner to:

- ◆ analyse the task and decide on a course of action for undertaking the project
- ◆ plan and organise work and carry it through to completion
- ◆ reflect on what has been done and draw conclusions for the future
- ◆ produce evidence of meeting the aims which this Graded unit has been designed to cover.

The project should include marine engineering based topics such as design of lubrication systems onboard, engine room crane systems, sewage systems, dual fuel engine feasibility report, etc.

Conditions of assessment

The learner should be given a date for completion of the project. However, the instructions for the project should be distributed to allow the learner sufficient time to assimilate the details and carry out the project. During the time between the distribution of the project instructions and the completion date, assessors may answer questions, provide clarification, guidance and reasonable assistance. The project should be marked as soon as possible after the completion date. The final grading given should reflect the quality of the learner's evidence at the time of the completion date.

The learner should pass each stage of project, ie planning phase, developing phase and evaluation phase.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Marine Engineering: Graded Unit 2
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Evidence Requirements for this Graded unit

The project undertaken by learners will consist of three stages: planning; developing; and evaluating. The following table specifies the minimum evidence required to pass each stage.

Project stage	Minimum Evidence Requirements
Stage 1 — Planning	<ul style="list-style-type: none"> ◆ The task undertaken by the learner must be unfamiliar and complex ◆ A project brief identifying customer requirements ◆ A project specification, detailing resources, that the customer has agreed ◆ A set of project objectives ◆ A project schedule <p><i>The learner must achieve all of the minimum evidence specified above in order to pass the Planning stage.</i></p>
Stage 2 — Developing	<ul style="list-style-type: none"> ◆ Information about the different solutions ◆ Justification of the chosen solution ◆ Verification strategy ◆ Practical outputs from the project (design, analysis, installation or investigation, etc) ◆ Records of progress underpinning the project such as: <ul style="list-style-type: none"> — log book — progress reports — test results or investigation findings as part of the verification strategy ◆ Complies with Health and Safety requirements <p><i>The learner must achieve all of the minimum evidence specified above in order to pass the Developing stage.</i></p>

Higher National Graded Unit specification: Designing the assessment task and assessing learners (cont)

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Project stage	Minimum Evidence Requirements
Stage 3 — Evaluating	<ul style="list-style-type: none"> ◆ Review of project specification as the project progresses ◆ Review of project schedule as the project progresses ◆ Analysis used to decide project option ◆ Progress reporting and goal setting as part of project implementation ◆ Actions taken to overcome unforeseen circumstances ◆ Interpretation of test results or investigation findings ◆ Action taken as a result of test results or investigation findings interpretation ◆ An assessment of the strengths and weaknesses of the practical output of the project ◆ A presentation to evaluate the extent the project brief and objectives have been delivered, covering salient technical aspects of the project ◆ Indication of any knowledge and skills which have been gained by the learner ◆ Complies with Health and Safety procedures
	<p><i>The learner must achieve all of the minimum evidence specified above in order to pass the Evaluating stage.</i></p>

The use of the *Marine Engineering: Graded Unit 2 Project Checklist* on Page 12 ensures the following approximate marks distribution between the Planning, Developing and Evaluating stages of the project:

Project stage	Approximate percentage of marks
Planning	30
Developing	45
Evaluating	25

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

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Assessing and grading learners

The overall project will be marked out of **100**. Only whole marks should be used.

The percentage of marks allocated to each stage of the project is outlined in the **Evidence Requirements**.

It is a requirement that learners must meet the minimum *Evidence Requirements* for the *Planning* stage before progressing to the *Developing* stage before progressing to the *Evaluating* stage. Learners may produce evidence over and above that specified in the minimum *Evidence Requirements* and deserve more than half the available marks for that stage. Assessors should use the Grade Related Criteria outlined below to judge learner performance.

Learners are required to work independently to meet the *Evidence Requirements* of the Graded unit. At the same time, learners need appropriate support. SQA uses the term reasonable assistance to describe the balance between supporting learners in their project and not providing too much assistance.

At the end of *each* stage there should be opportunities for remediation and re-assessment of learners for that particular stage. This includes the final *Evaluation* stage. Any re-assessment should be carried out in line with the centre's own assessment policy. Re-assessment should follow the minimum Evidence Requirements for each stage outlined under the Evidence Requirements for this Graded unit.

Grade A	Grade C
<p>Is a seamless, coherent piece of work which:</p> <ul style="list-style-type: none"> ◆ Includes a project brief that contains complex, multi-variable information about the main technical requirements of the project and provides a cost indication and expected timescales. ◆ Contains a project specification which provides clear details of the following: the title of the project; the objectives of the specification; the project's main technical requirements including multi-variables and an acknowledgement of any references or standards relevant to the specification. 	<p>Is a co-ordinated piece of work which:</p> <ul style="list-style-type: none"> ◆ Includes a project brief that contains all relevant information, is written clearly and concisely and has been agreed fully with the customer. ◆ Contains a project specification that is well structured, contains relevant, accurate information and any revisions made have been agreed with the customer.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Marine Engineering: Graded Unit 2
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Grade A	Grade C
<ul style="list-style-type: none"> ◆ Includes project objectives that identify the key long term project targets and multi-variables. ◆ Includes an initial project schedule (probably in the form of a Gantt chart) which contains a comprehensive list of project activities and timings. The information in the initial schedule is used to assess if the project can be completed within timescales. The schedule is monitored on a regular basis to inform on-going project planning and development. ◆ The learner develops a substantial knowledge base to support the demands of the project. ◆ The selected solution is justified in terms of a thorough evaluation of a range of options. ◆ A comprehensive verification strategy is developed to ensure the product is completely tested or the investigation findings are fully validated. ◆ The learner feeds back to her/his supervisor on a regular basis, updating the supervisor on progress made and actions for the next stages of the project. ◆ The learner accesses components and/or, software and/or materials to support an investigation of the correct specification from a range of sources at the most economic price. 	<ul style="list-style-type: none"> ◆ Includes project objectives which accurately and fully reflect in the long term project targets. ◆ Includes an initial project schedule (probably in the form of a Gantt chart) which shows all essential project activities and timings. Evidence that the schedule has been monitored on at least three separate occasions during the life of the project to inform on-going project planning and development should be available. ◆ The learner develops a sound knowledge base to support the demands of the project. ◆ The selected solution is justified in terms of a sound evaluation involving the solution and at least one viable alternative option. ◆ A verification strategy is developed to test the essential parts of the product or to validate the principal investigation findings. ◆ The learner feeds back to her/his supervisor on at least three occasions providing an indication of progress made. ◆ The learner accesses components and/or software and/or materials to support an investigation of the correct specification from a range of sources.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Marine Engineering: Graded Unit 2
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Grade A	Grade C
<ul style="list-style-type: none"> ◆ The product is constructed to a high standard and functions correctly or the investigation is carried out in a comprehensive manner. ◆ All tests on the product are conducted in a technically correct way with due account being taken of inaccuracies introduced by the measurement processes or comprehensive checks are made on investigation data to ensure full confidence in the reliability and accuracy data. ◆ The interpretation of test results or investigation data is accurate and the analysis of the results or data is used to identify improvements in product performance or the Outcomes of the investigation. ◆ The log book contains a complex level of detail about project ideas and progress and there is evidence that entries have been made on at least six occasions during the life of the project. ◆ The project report is well structured, contains only relevant information, has clear and accurate conclusions and recommendations and is written in clear and correct English. ◆ The project report includes a complex and comprehensive evaluation of the project strategy and activities and includes clear evaluation of what the learner has learnt from undertaking the project and the factors involved. ◆ The presentation is well structured, contains only relevant information, is to time and includes the use of appropriate aids. 	<ul style="list-style-type: none"> ◆ The product is constructed to an acceptable standard of quality or the investigation is carried out in a sufficiently detailed manner. ◆ Tests are carried out in a technically proficient way or sufficient checks are made on the investigation data to ensure reasonable confidence in the reliability and accuracy of the data. ◆ The interpretation of test results or investigation data is correct. ◆ The log book is regularly maintained and provides a detailed, informal record of the learner's thinking as the project develops including reflective comments. ◆ The project report meets acceptable standards in terms of structure, use of English and clarity, and has accurate conclusions and recommendations. ◆ The project includes an evaluation of the project strategy and activities and includes an evaluation of what the learner has learnt from undertaking the project. ◆ The presentation is acceptably structured, contains largely relevant information and is to time.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Marine Engineering: Graded Unit 2
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Grade A	Grade C
<ul style="list-style-type: none"> ◆ The learner gives clear, concise and technically accurate answers to questions raised during the presentation ◆ The learner includes a complex, reflective account of the success, or otherwise, of project activities against project objectives in the presentation. ◆ The learner undertakes the project with the minimum of supervision. ◆ The learner identifies clear and full details of the new knowledge and skills she/he has developed as a result of doing the project such as project management skills, investigation/ research skills, keeping to deadlines, recognising limitations of knowledge — approaching expert sources. ◆ The learner introduces a significant novel feature into the project. ◆ The learner demonstrates a high level of self-motivation throughout the project. ◆ The learner undertakes additional research well beyond that demanded by the project. 	<ul style="list-style-type: none"> ◆ The learner gives technically correct answers to questions raised as part of the presentation. ◆ The learner includes a reflective account of the success, or otherwise, of the project in the presentation. ◆ The learner undertakes the project without unnecessary interventions from the project supervisor to ensure the project remains on track. ◆ The learner provides at least three examples of new knowledge and skills she/he has developed as a result of doing the project. ◆ None ◆ The learner demonstrates an acceptable level of motivation throughout the project. ◆ The learner takes on a limited amount of additional research.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Marine Engineering: Graded Unit 2
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The marks allocated to each stage will then be aggregated to arrive at an overall mark for the project. Assessors will then assign an overall grade to the learner for this Graded unit based on the following grade boundaries.

A = 70%–100%
B = 60%–69%
C = 50%–59%

These grade boundaries are fixed and should **not** be amended.

If a learner does not achieve a pass or wishes to upgrade, then this must be done using a substantially different project, ie all stages are undertaken using a new project (case study, investigation or practical assignment). In these circumstances, the highest grade achieved should be awarded.

More information on reasonable assistance, remediation and re-assessment may be found in the SQA publication *Guidance for the Implementation of Graded units in Higher National Certificates and Diplomas* (SQA, 2008, Publication code: CA4405).



Higher National Project-based Graded Unit Support Notes

Graded Unit title: Marine Engineering: Graded Unit 2
(SCQF level 8)

Guidance on approaches to delivery and assessment of this Graded unit

The project should be marked using the checklist shown on page 12. For each item shown in the checklist an assessor should circle the mark which most closely reflects the learner's performance against that item. In making a decision regarding which number to circle an assessor should use as her/his frame of reference the Grade A and Grade C criteria shown in the table on the previous pages. Grade C corresponds to 5 and Grade A to 10.

All the circled marks should be added together and the aggregated score entered into the formula shown below to arrive at an overall mark for the project.

$$\text{Overall project mark} = \frac{\text{Aggregated score} \times 100\%}{250}$$

Assessors will then assign an overall grade to the learner for this Graded unit based on the following grade boundaries.

A	=	70%–100%
B	=	60%–69%
C	=	50%–59%

NOTE: The learner must achieve all of the minimum evidence specified below for each stage of the project in order to achieve the Graded unit.

Guidance

- ◆ Centre may provide Engine Room Simulator, Marine Workshop access to the learners to enhance the quality of report.
- ◆ Centre may provide extra support on how to manage project, use Microsoft Project.
- ◆ Centre may provide clear feedback to each learner at each stage of the Project.
- ◆ Project can be marine operation related such as Oil Purification systems Design, Design of installation of sewage systems plant, engine room crane, Fire-fighting systems on-board, Feasibility report on the conversion of 2/4 Stroke Diesel Engine to dual fuel engine, etc.
- ◆ Access to wide marine journals, and ship manuals could be good resources for the learners.

Marine Engineering: Graded Unit 2 Project Checklist

Learner's name: _____ Learner's No: _____ Aggregated Score: _____

No	Project Item											
1	Project brief	0	1	2	3	4	5	6	7	8	9	10
2	Project specification	0	1	2	3	4	5	6	7	8	9	10
3	Project objectives	0	1	2	3	4	5	6	7	8	9	10
4	Project schedule	0	1	2	3	4	5	6	7	8	9	10
5	Knowledge base	0	1	2	3	4	5	6	7	8	9	10
6	Selected solution	0	1	2	3	4	5	6	7	8	9	10
7	Verification strategy	0	1	2	3	4	5	6	7	8	9	10
8	Learner feedback	0	1	2	3	4	5	6	7	8	9	10
9	Accessing materials	0	1	2	3	4	5	6	7	8	9	10
10	Product/investigation construction	0	1	2	3	4	5	6	7	8	9	10
11	Tests/data checks	0	1	2	3	4	5	6	7	8	9	10
12	Interpretation of test results or data	0	1	2	3	4	5	6	7	8	9	10
13	Log book	0	1	2	3	4	5	6	7	8	9	10
14	Project report	0	2	4	6	8	10	12	14	16	18	20
15	Project report evaluation	0	1	2	3	4	5	6	7	8	9	10
16	Presentation	0	2	4	6	8	10	12	14	16	18	20
17	Question and answers	0	1	2	3	4	5	6	7	8	9	10
18	Presentation evaluation	0	1	2	3	4	5	6	7	8	9	10
19	Level of supervision	0	1	2	3	4	5	6	7	8	9	10
20	New knowledge and skills developed	0	1	2	3	4	5	6	7	8	9	10
21	Novel feature	0	1	2	3	4	5	6	7	8	9	10
22	Level of motivation	0	1	2	3	4	5	6	7	8	9	10
23	Additional research	0	1	2	3	4	5	6	7	8	9	10

Higher National Project-based Graded Unit Support Notes

Graded Unit title: Marine Engineering: Graded Unit 2
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The Marine Engineering Project can consist of one of the following:

- ◆ Marine Diesel Engines/Steam Operation, watch-keeping, maintenance
- ◆ Hardware and software
- ◆ Marine Auxiliary systems
- ◆ Marine Engineering systems design (may include the use of software, simulation, workshop)
- ◆ Investigation of a technical issue leading to a report with a clear set of recommendations, ie MAIB reports may be used

The assessment task requires the learner to:

- ◆ Procedure a project brief, specification
- ◆ Produce project objective which define the long term project objectives
- ◆ Draw up an initial project schedule which should be used to inform on-going project planning and development
- ◆ Justify chosen project solution in relation to one or more alternative solutions
- ◆ Develop a verification strategy for the project
- ◆ Feed back to project solution in relation to one or more alternative solutions
- ◆ Access components, software, materials for an investigation
- ◆ Implement project solution
- ◆ Test product or check investigation data to confirm validity of this data
- ◆ Analyse test results or investigation data
- ◆ Maintain a log book throughout the duration of the project
- ◆ Write a project report which conforms to appropriate report writing standards, includes an evaluation of the project strategy and what the learner has learnt from undertaking the project
- ◆ Present details of the project including a reflective account of the project Outcomes

Opportunities for developing Core and other essential skills

The achievement of this unit gives automatic certification of the following: *Problem Solving* at SCQF level 6.

There are also further opportunities to develop the Core Skills of Written Communication at SCQF level 6, Oral Communication at SCQF level 6 and Working Co-operatively with Others at SCQF level 6.

History of changes

Version	Description of change	Date

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General information for learners

Graded Unit title: Marine Engineering: Graded Unit 2 (SCQF level 8)

As part of the 2nd year HND Marine Engineering programme of study you will have to complete a two credit Graded Unit Project.

Engineering technicians and incorporated engineers are frequently asked to get involved in project work. Such work in industry is much more than simply designing and making an item. It starts with understanding the customer requirements and translating these into a project specification and objectives. It leads into proper project scheduling to ensure 'all the elements of the project' come together on time. It then proceeds to implementing the project and applying an appropriate verification strategy to ensure the project is thoroughly tested. There will also be the paperwork that has to be completed at the end of the project. From this you can see that running even a small practical assignment based project in industry can be a complex business requiring good planning and organisational skills.

The *Marine Engineering: Graded Unit 2* has been designed to allow you to develop many of the skills you will require to see a project through from start to finish. Such skills will include technical ones, but you will also develop a very important range of non-technical skills which are required to successfully manage a project such as planning and organisation, oral and written communication, customer care, evaluation skills, time management and many more.

The project will be broken down into the following three stages: planning, development and evaluation. Your lecturer will expect you to produce documentation for all three stages. Typical documentation will include a project brief, specification, objectives and schedule, a log book and a project report. You will also be required to do ten minute presentation about your project followed by a five minute question and answer session.

Your project will be graded based on the following:

Grade	Marks achieved
A	70%–100%
B	60%–69%
C	50%–59%

Your lecturer will mark your work using a 23 point checklist which will allow your mark to be identified for each of the three Graded unit stages — planning, development and evaluation, each with its own Minimum Evidence Requirements. If you meet the Minimum Evidence Requirements and obtain the required minimum 50% mark overall, your achievement will be graded as C (competent), A (highly competent), or B (somewhere between A and C) as indicated above.

Your lecturer will provide you with a guide on how you should undertake project work and explain to you the Minimum Evidence Requirements and the criteria on which your project work will be assessed.